No. 2

PROVISIONAL INTELLIGENCE REPORT

THE ELECTRIC POWER INDUSTRY OF NORTH KOREA

CIA/RR PR-148
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CENTRAL INTELLIGENCE AGENCY

OFFICE OF RESEARCH AND REPORTS

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S-E-C-R-E-T

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THE ELECTRIC POWER INDUSTRY OF NORTH KOREA

CIA/RR PR-148

(ORR Project 27.878)

NOTICE

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FOREWORD

The purpose of this report is to describe, to the extent made possible by available data, the present status and probable future development of the electric power industry of North Korea. The scope of the study is definitely limited by lack of recent data on the industry. Since 1945 there has been little reliable information on the capacity and production of individual electric power plants in North Korea; on labor, investment, and production costs; and on consumption of electric power by the major users. Although it is known that the government of North Korea has been reconstructing the electric power facilities damaged during World War II and the Korean War, the extent of the rehabilitation is not known.

In spite of the limitations of this report, it provides a survey of available information on the electric power industry of Korea, and it will serve as a base for continued study of the industry when definitive data become available.

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THE ELECTRIC POWER INDUSTRY OF NORTH KOREA*

Summary

In 1956 the electric power industry of North Korea will produce about 4.3 billion kilowatt-hours (kwh), and at the end of the year the industry will have a capacity of 1.33 million kilowatts (kw). In terms of both production and capacity the North Korean electric power industry is about one-third as large as that of Communist China. Manchuria, which has about 6 times the population and area of North Korea, has only about twice the production of electric power and 1.4 times the electric power capacity of North Korea.

The 1956 capacity of the electric power industry of North Korea, 1.33 million kw, will be about 90 percent of the all-time peak capacity of the industry -- about 1.5 million kw in 1945 at the time of the expulsion of the Japanese. This all-time peak capacity had been built up by the Japanese over a period of 20 years to supply the power for a major development of the production of chemical fertilizers in North Korea. The supply of relatively cheap hydroelectric power also made possible the development of the metallurgical, mining, and cement industries.

During the Korean War the electric power facilities of North Korea were severely damaged, and rehabilitation of those facilities has been a major objective of the government of North Korea. The program of reconstruction has been successful to the extent that in 1956 the chemical fertilizer industry is again the base of the industrial economy of the country.

Of the total electric power capacity in North Korea, hydroelectric power plants account for about 96 percent, and thermal electric plants account for the remainder. The rivers of North Korea are excellent sources of hydroelectric power, and water supply will not be a limiting factor in the development of the electric power industry of the country. It is likely that about 96 percent of the capacity of the industry will continue to be in hydroelectric stations.

* The estimates and conclusions contained in this report represent the best judgment of ORR as of 1 July 1956.

Expansion of the electric power industry in North Korea may be limited, however, by the availability of imports of heavy electrical generating equipment. North Korea has neither the skills nor the facilities to produce large turbines and generators, and there is little likelihood that facilities will be acquired in the near future. Because of existing embargoes, heavy electrical generating equipment must be imported from other countries of the Sino-Soviet Bloc, probably from the USSR, Czechoslovakia, and Hungary. Thus far, only the USSR is known to have supplied any equipment -- large transformers to be used in the rehabilitation of the industry after the Korean War.

North Korea exports electric power to Manchuria to supply heavy industry there. This export of electric power undoubtedly serves as a medium of foreign exchange between North Korea and Communist China, but there is no available information on the value of this exchange or on the nature of Chinese Communist payments to North Korea.

I. Introduction.

A. General.

As considered in this report, the electric power industry of North Korea includes the generation of electric power and its transmission and distribution to the ultimate consumers. The physical facilities involved are all hydroelectric and thermal electric power plants (except small plants, frequently portable, used for emergency and military purposes) and all transmission and distribution facilities. The power plants include those which supply electricity to the public and those which are industry owned and supply power primarily for industrial operations. In this report, detailed discussion will be limited to power plants having capacities of 1,000 kw or more and to transmission lines operating at 60 kilovolts (kv) or more.

Although the Ministry of Electricity is responsible for the manufacture and purchase of electrical equipment (transformers, wire, cable, auxiliary transmission equipment, motors, and small electrical appliances), the manufacture and procurement of equipment are not discussed.

This report covers the period since World War II (1945-49), the period of the Korean War (1950-53), the reconstruction period (1954-56), and the period of the First Five Year Plan (1957-61). For historical and comparative purposes, it also gives brief attention to the prewar and wartime periods.

North Korea is bounded on the north by the Yalu and Tumen Rivers and on the south by an arbitrary truce line near the 38th parallel, running approximately from Munsan on the west coast through Ch'orwon to Kosong on the east coast.

B. Importance of the Industry.

The efficient development and expansion of almost all industries depend on a supply of electric power. Many specialized industries and processes have no substitute for electric power -- in North Korea, for instance, the development of the important electrochemical industry was made possible by the development of an inexpensive and abundant supply of hydroelectric power. The production of zinc and of the many ferrous alloys which are produced in North Korea can also be accomplished more economically in electric furnaces.

C. Historical Development.

The development of an electric power industry in North Korea began in 1926 with the construction of the Fusen (Pujon)* hydroelectric power system by the Japan Nitrogenous Fertilizer Company, Ltd., as a source of power for its vast electrochemical industry being built at Hungnam. This was the beginning of industrialization in North Korea. The construction of the Fusen system was followed by the development of the Choshin (Changjin) and Kyosen (Hoch'on) systems as additional sources of electric power for the chemical industry. In addition, three smaller hydroelectric power systems were also constructed -- Funei (Puryong) in the northeast, Kongo-san (Kumgang-san) in the south, and Kasan (Hwach'on) near the 38th parallel and now located in South Korea. 1/** The development of the Yalu River was begun in the late

* In the text of this report the more common Japanese names are used in referring to the hydroelectric power systems, and Korean names are used for natural features and individual electric power plants. In Figure 3 (inside back cover), a map showing the major electric power facilities in North Korea, only Korean names are used.

** For serially numbered source references, see Appendix E.

1930's with the construction of the Sup'ung (Suiho) dam, which is now the largest hydroelectric power plant in the Far East and the second largest in the Sino-Soviet Bloc. The completion of this plant in early 1945 ended the rapid development of the electric power industry by the Japanese, although they had plans for the further development of the Yalu River. 2/

D. Organization.

The Japan Nitrogenous Fertilizer Company, Ltd., controlled the electric power industry of Korea until 1945, when its assets north of the 38th parallel were seized by the North Korean government and later nationalized. 3/ Initially, the nationalized electric power industry was under the control of the Electric Bureau, with subordinate Electric Supply Bureaus in each province. 4/ In late March 1954 there was a general government reorganization, and the Electric Bureau was designated the Ministry of Electricity. 5/ It is assumed that the organization of the electric power industry remained essentially the same after its change from a cabinet post to a ministry post. For each province there is an Electric Supply and Distribution Department which controls the operations of all generating stations and substations within its boundaries. 6/ The distribution of load on the electric power plants and the supply of power to the load centers are controlled by local load dispatchers (possibly on a provincial level), who, in turn, are supervised by a main load dispatcher directly under the Minister of Electricity.

E. Natural Resources.

With the exception of petroleum, North Korea is well endowed with natural resources for the production of energy in its various forms.

The hydroelectric resources of North Korea are estimated to be approximately 5.3 million kw, 7/ of which slightly more than one-fourth has been developed. The Japanese had planned additional installations which would have resulted in the use of at least one-half of the total resources. 8/ Construction had been started by the Japanese at several locations, but there have been radical political and economic changes in the past 10 years, and the extent to which the original plans may eventually be revised or carried out is not known.

The coal resources of North Korea total approximately 2 billion metric tons. Of this total, 1.5 billion metric tons are of extremely good quality (6,500 to 7,000 kcal/kg*) anthracite, and 0.5 billion metric tons are soft (brown) coal. 9/ It is estimated that thermal electric power production in 1956 will consume about 70,000 metric tons of coal, or less than 2 percent of the estimated coal production. Thus coal resources can be considered ample for the production of thermal electric power, which accounts for only about 3 percent of the total production of electric power and probably will remain at this level.

II. Generating and Transmission Facilities.

A. Generating Plants.**

As a result of the aggressive exploitation of the hydroelectric power resources of North Korea by the Japanese, the electric power generating plants reached the peak of their development in 1945, shortly before the end of World War II, with an estimated capacity of approximately 1.5 million kw,*** more than 50 percent above that at the end of 1955 (0.97 million kw). The great reduction of generating capacity in the 10 years following World War II was partly a result of damage and removal of equipment by the Japanese and Russians during and after the war, but it was mainly a result of dismantling and of severe bombing damage by the UN during the Korean War. Recovery from the low of about 200,000 kw in 1952*** 10/ has been so substantial that it is estimated that by the end of 1956 the capacity of the electric power industry will be about 1.33 million kw, 90 percent of the 1945 peak. The wide variations in annual capacity were caused by destruction of the facilities and subsequent rehabilitation. Capacity of the electric power industry of North Korea in 1949-56 is shown in Table 1**** and in Figure 1.*****

A few statements about damage to and destruction of the electric power facilities of North Korea will show the magnitude of the restoration. Forced out of Korea by the advancing Russians in 1945, the Japanese

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* Kilocalories per kilogram -- a measure of heat content.

** For a list of electric power generating plants in North Korea, see Appendix A.

*** It should be noted that in Figure 1, following p. 6, the points represent conditions at the end of the year, whereas the high and low points mentioned above for 1945 and 1952 occurred at other times during the year. Hence there is a difference in values between the text and the figure.

**** Table 1 follows on p. 6.

***** Following p. 6.

Table 1

Capacity of the Electric Power Industry of North Korea a/
1949-56

Megawatts b/

System	1949	1950	1951	1952	1953	1954	1955	1956
Sup'ung	360	360	360	180	90	180	270	450
Choshin	297	64	64	32	89	157	217	297
Fusen	149	68	68	0	29	76	178	178
Kyosen	316	126	126	16	64	127	237	316
Kongo-san and Funei	37	19	19	1	15	18	25	42
Total hydroelectric	1,159 c/	637	637	229	287 d/	558 e/	927 f/	1,283
Thermal electric	81	14	14	21	21	28	41	50
Total	1,240	651 g/	651	250	308	586	968	1,333

a. Figures not otherwise sourced are estimates based on plants known or believed to have been in operation. For methodology, see Appendix C.
b. One megawatt equals 1,000 kw.
c. 11/
d. 12/
e. 13/
f. 14/
g. 15/

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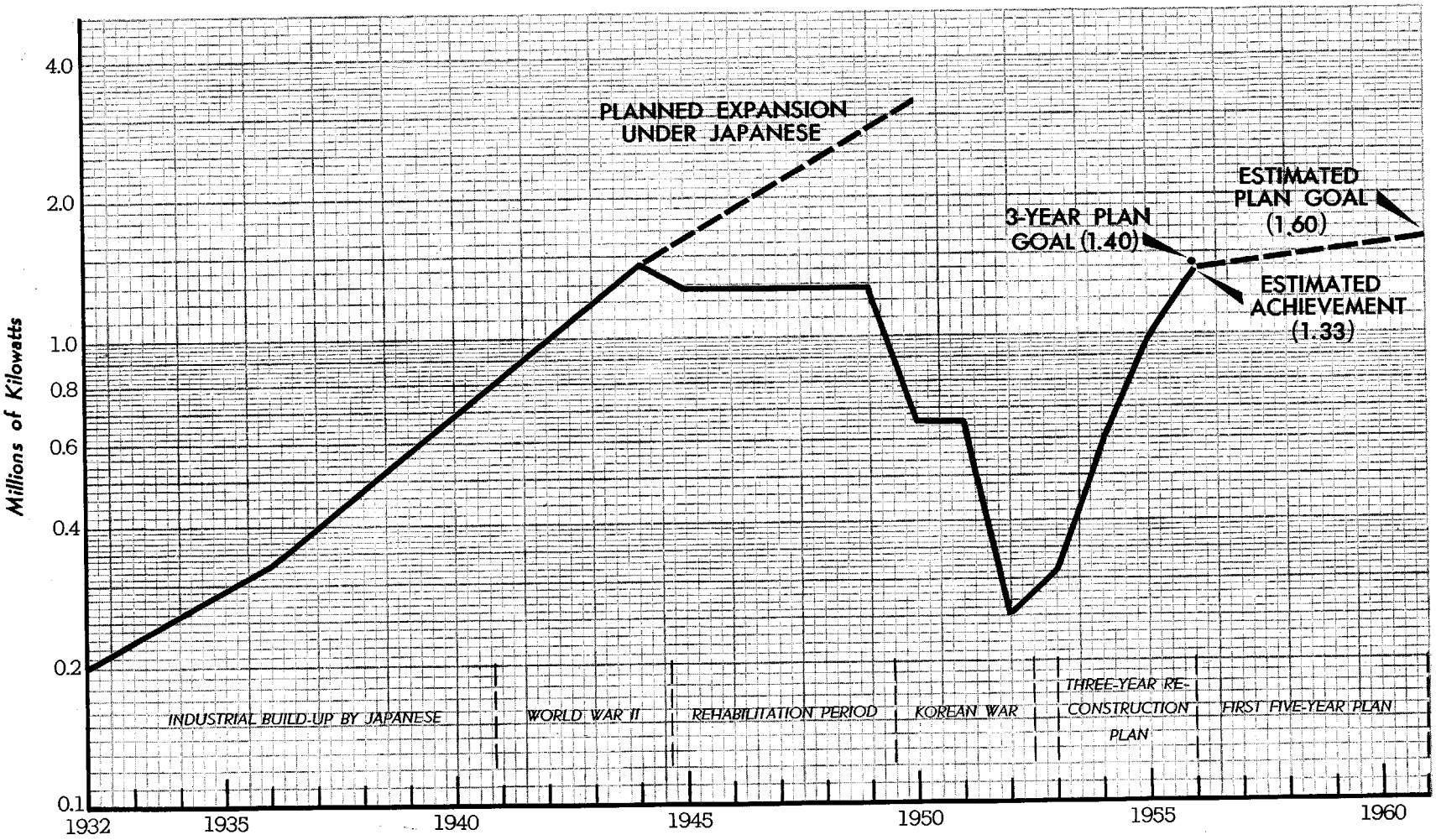
FIGURE 1

NORTH KOREA
ELECTRIC POWER GENERATING CAPACITY
1932-61



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destroyed and damaged an estimated 100,000 kw of generating facilities. The USSR further reduced the total by removing 180,000 kw of equipment from the Sup'ung hydroelectric power plant. 16/ Before the outbreak of hostilities in June 1950 the North Koreans had dismantled and removed to adjacent protected locations or had sandbagged more than one-half of their generating capacity. Although the major hydroelectric power plants were bombed repeatedly during 1952, the generating units probably received very little direct damage. Heavy damage, however, was done to buildings and appurtenant structures and to transformers, substation equipment, and tramsmission lines and towers. Damage to penstocks (large water conduits leading to hydraulic turbines) contributed greatly to the loss of capacity.

The hydroelectric generating capacity, upon which North Korea is almost entirely dependent for its supply of electric power, is contained in a surprisingly small number of plants. These plants, with the exception of the Sup'ung plant on the Yalu River, fall into five groups, or systems. Each system is composed of a series, or "cascade," of plants, all using the same water source. The water is conveyed from a reservoir at a high level to the several plants at successively lower levels by means of tunnels and penstocks. Although the reservoirs are located on the western slope of the mountain range, damming of the rivers has made it possible to divert water over the drainage divide to the power plants on the precipitous eastern slope, thus using natural terrain to the best advantage. A system is commonly referred to by the name of its water source. Following are brief comments on the status of each system.

1. Sup'ung Hydroelectric Power Plant.

The Sup'ung hydroelectric power plant was originally designed for seven 90,000-kw generating units. These units were not identical, because the plant was designed to supply both Manchuria, where 50-cycle current is used, and North Korea, where 60-cycle current is used. Because one unit, Unit No. 5, was never installed, the plant never reached full rating. 17/

It is probable that the major damage at Sup'ung was restricted to the transformers and transmission equipment because generators were well protected. The status of each unit 18/ is indicated in the following tabulation:

Unit	Date in Operation	Cycles	Supplying
No. 1	Not disrupted	50/60*	North Korea (initially)
No. 2	1954	50/60	North Korea
No. 3	Late 1956	50/60	Manchuria
No. 4	February 1956	50	Manchuria
No. 5	Never installed	50/60	
No. 6	July 1955	60	North Korea
No. 7	Probably 1957	60	North Korea

The capacity of and distribution from the Sup'ung hydroelectric power plant in 1945 and 1949-57 are shown in Table 2.

Table 2

Capacity of and Distribution from the Sup'ung Hydroelectric Power Plant a/ 1945 and 1949-57 b/

Megawatts

	1945	1949	1952 c/	1953 c/	1954	1955	1956	1957
Capacity	540	360	180	90	180	270	450	540
Supply								
To North Korea	180	180	180	90	180	180	180	180
To Manchuria	360	180				90	270	360

a. 19/
b. Figures for 1950 and 1951 are the same as those for 1949.
c. From mid-1952 to mid-1953 the plant was completely inoperable during periods totaling about 4 months.

* This 50/60-cycle unit probably was transferred to supply Manchuria when Unit No. 6 was put into operation. Upon complete restoration of the plant, Unit No. 2 probably will also supply Manchuria, thus allotting approximately 60 percent of output to Manchuria and 40 percent to North Korea. One of the 50/60-cycle units probably will be put on a standby basis.

2. Choshin Hydroelectric Power System.

The major part of the generating equipment in the four plants of the Choshin hydroelectric power system is believed to have been dismantled or sandbagged early in 1950. 20/ It is probable that very little damage was done to the generators in the bombing during June 1952, but there was extensive damage to the outdoor installations and equipment. The disruption of transmission facilities and rupturing of penstocks resulted in an immediate loss of all available capacity, but the system was put back into partial operation less than 1 month after the attacks. 21/ Rehabilitation of the system, with material and technical assistance from Czechoslovakia, was started immediately after the armistice. 22/

The capacity of the Choshin hydroelectric power system in 1949-56 is shown in Table 3.

Table 3

Capacity of the Choshin Hydroelectric Power System a/
1949-56 b/

Megawatts

Plant	1949	1950	1952	1953	1954	1955	1956
No. 1	128	64	32	64	96	96	128
No. 2	100			25	50	75	100
No. 3	36					24	36
No. 4	33				11	22	33
Total	297	64	32	89	157	217	297

a. 23/
b. The figures for 1951 are the same as those for 1950.

3. Fusen Hydroelectric Power System.

Although the Fusen hydroelectric power system had an installed capacity of 178 megawatts (mw) before the Soviet occupation, in 1945 a generating unit was damaged which had not been repaired before the Korean

War. Plant No. 1 was the only hydroelectric power plant bombed in the early stages of the war. 24/ Plants Nos. 2 and 3 probably were dismantled as a protective measure. There is no information as to whether or not protective measures such as were taken on other systems were taken on this system. The bombing during June 1952 resulted in extensive damage to Plant No. 4, possibly because it was the only one in operation. 25/

The capacity of the Fusen hydroelectric power system in 1949-56 is shown in Table 4.

Table 4

Capacity of the Fusen Hydroelectric Power System a/
1949-56 b/

Megawatts

Plant	1949	1950	1952	1953	1954	1955	1956
No. 1	87	58	0	29	58	116	116
No. 2	36		0		18	36	36
No. 3	16		0			16	16
No. 4	10	10	0			10	10
Total	149	68	0	29	76	178	178

a. 26/
b. The figures for 1951 are the same as those for 1950.

4. Kyosen Hydroelectric Power System.

The bombing during June 1952 resulted in an almost complete loss of the capacity of the Kyosen hydroelectric power system because of the disruption of transmission facilities and the damage to penstocks. 27/ The system was in partial operation throughout the Korean War, 28/ and after the armistice it was gradually restored. By the end of 1955, 12 generating units were in operation. 29/

The capacity of the Kyosen hydroelectric power system in 1949-56 is shown in Table 5.

Table 5

Capacity of the Kyosen Hydroelectric Power System
1949-56 a/

Megawatts

Plant	1949	1950	1952	1953	1954	1955	1956
No. 1	128	32		32	64	96	128
No. 2	64	32			16	48	64
No. 3	60	30			15	45	60
No. 4	64	32	16	32	32	48	64
Total	316	126	16	64	127	237	316

a. The figures for 1951 are the same as those for 1950.

5. Kongo-san and Funei Hydroelectric Power Systems.

In addition to the large hydroelectric systems, two small systems, the Kongo-san and Funei systems, were in operation. The capacity of the Kongo-san and Funei hydroelectric power systems in 1949-56 is shown in Table 6.

Table 6

Capacity of the Kongo-san and Funei Hydroelectric Power Systems a/
1949-56 b/

Megawatts

System	1949	1950	1952	1953	1954	1955	1956
Kongo-san	14	8	1	4	4	8	14
Funei	23	11		11	14	17	28

a. 30/
b. The figures for 1951 are the same as those for 1950.

6. Thermal Electric Power Plants.

The total capacity and electric power production of the coal-fired thermal electric power plants of North Korea are insignificant, less than 3 percent of the national totals in 1956. A compilation of all available information on these plants reveals that before World War II there were 34 plants with a total combined capacity of 160,000 kw. At the end of the war there were 15 plants with a combined capacity of 80,000 kw. It is probable that there now are 8 plants with a combined capacity of about 50,000 kw, all of them supplying power primarily for industrial use. The reduction in the number of plants and in total capacity probably was a result of the development of the hydroelectric resources. Thermal electric power plants in North Korea in 1956 are shown in Table 7. The table includes the thermal electric power plants that probably have been restored and are either now in operation or soon will be in operation.

Table 7

Thermal Electric Power Plants in North Korea
1956

Kilowatts

Location	Type of Industry Served	Capacity a/
Aoji-dong	Synthetic fuels	5,000
Ch'ongjin	Steel mill	16,000 b/
Ch'onnae-ri	Cement works	3,600
Haeju	Cement works	3,000
Hungnam	Chemical plant	13,000
Komusan c/	Cement works	3,600
Myongch'on	Synthetic fuels	4,000
Pongsan c/	Cement works (Madong)	7,100
Sungho-ri	Cement works	10,200
Total		65,500

a. Except where otherwise noted, figures were obtained from source 31/ and represent reported capacity before the Korean War. It is probable that these plants were restored to their former capacities.
b. Not believed to be fully restored or in operation.
c. 32/

The power plants connected with the various cement works are operated from the waste heat from the cement kilns and are capable of producing about 90 percent of the electric power requirements for producing cement. The power plant located in the Ch'ongjin steel mill will also operate from waste heat from the blast furnace. This type of operation results in a considerable saving in fuel as well as in the use of energy that would otherwise be lost.

B. Transmission Facilities.

High-tension electric power transmission lines are of prime importance because they transport electric power over long distances from electric power plants to the load centers in industrial plants and cities. They also tie together all the power plants of one or more systems and thus make the aggregate of the capacity of all plants available to meet the demand. With adequate interconnection of power sources, the demand on a power system can be shifted between the power plants to permit the most efficient operation. In the event of a serious breakdown in any plant, the load being supplied by that plant can be allocated to other plants in the system. Aside from the operating advantages, capital investment for new generating facilities may be reduced or deferred because a part, or even all, of the additional supply of power may be made available from the aggregate capacity of all the plants interconnected by adequate transmission lines.

The transmission facilities of North Korea can best be considered as two separate systems, both based on a framework of 220-kv transmission lines.* The Sup'ung hydroelectric power plant supplies the west coast between the Yalu River and Haeju, the major load being in the area around P'yongyang. On the east coast the Fusen and Choshin systems are interconnected with the Kyosen system for the supply of that area and of Hungnam in particular. In addition to the 220-kv interconnection, there is a 110-kv interconnection paralleling the east coast and extending into the northernmost area of North Korea.

There is an interconnection between the east- and west-coast systems by means of a 154-kv transmission line which emanates from the Choshin system and terminates at P'yongyang. Before 1948 this line

* For a list of the major electric power transmission facilities in North Korea, see Appendix B and the map, Figure 3, inside back cover.

continued to Seoul, but since 1948 it has been partially dismantled. 33/ At present, the interconnection between the two systems is inadequate; the present transformers and related equipment limit the delivery of the amount of electric power which might be available from either source. 34/

In 1949 there were approximately 2,400 miles of transmission lines in North Korea. 35/ Distribution, by operating voltage and circuits, was as follows:

Miles

	Transmission Lines				
	220-kv	154-kv	110-kv	66-kv*	Total
Single-circuit line	394	39	9	1,265	1,707
Double-circuit line	0	221	373	62	656
Total	394	260	382	1,327	2,363

There are very few reports and announcements concerning the rehabilitation of the transmission facilities in North Korea, but it is assumed that those facilities are being restored and expanded along with the restoration of the generating facilities. In addition to major reconstruction of transmission facilities, the plan for the reconstruction period, 1954-56, called for an increase of 6 percent in new transmission mileage over that in 1949. 36/ A 6-percent increase means the addition of only 144 miles, a seemingly small amount, but no new plants requiring transmission facilities will be ready by 1956. The existing plants will be served by existing and rehabilitated transmission lines.

The location of the 144 miles of new transmission lines is not known, but it is probable that about 80 miles of them will form a link between Sup'ung and the new Kokai No. 4 plant now under construction.**

* By type of use, all of the single-circuit 66-kv lines probably should be considered distribution lines rather than transmission lines.
** For additional information, see IV, B, p. 21, below.

There is only one known major international exchange point, at the Sup'ung hydroelectric power plant, crossing the Yalu River into Manchuria. There are two 220-kv transmission lines involved, one extending down the Manchurian coast to Dairen and the other extending inland to An-shan. Although it has not been confirmed, there is a report that aerial river crossings were replaced with submarine cables in late 1955. 37/

Before 1948 there were also two 154-kv transmission lines extending from North Korea into South Korea -- one from P'yongyang via Namch'onjom and Kaesong to Seoul and the other from the Hwach'on hydroelectric power plant, just north of the 38th parallel, to Seoul. 38/ In May 1948, both of these lines were disconnected, probably by removing wire at the 38th parallel and by opening switches at Namch'onjom and Hwach'on, thus severing the supply of electric power to South Korea. Since May 1948 the section of the P'yongyang-Seoul line between Namch'onjom and Kaesong has been removed. 39/ Because the truce line has been established about 20 miles north of the 38th parallel in the eastern section, the Hwach'on-Seoul line is now completely in South Korea.

There is an unconfirmed report of a transmission line from Aoji-dong to Kraskino, Primorskiy Kray, USSR. 40/ This line possibly could be an extension of the 110-kv line extending up the east coast, and it may even extend to Vladivostok.

III. Production, Consumption, and Exports.

A. Production.

During the 20 years beginning in the mid-1930's, production of electric power in North Korea varied widely. The variation was the result of several economic and military events of major significance which followed each other in rapid succession. There was the abnormally rapid expansion of industry under Japanese rule, which ended abruptly with the expulsion of the Japanese at the end of World War II. 41/ Rehabilitation followed for about 5 years, only to be interrupted by the Korean War, which virtually stopped industrial activity and consequently the production of electric power.

The effect of these events on production of electric power in North Korea is shown in Figure 2.* Production of electric power in North Korea in 1945-56 is shown in Table 8.**

* Following p. 16.
** Table 8 follows on p. 16.

Table 8

Production of Electric Power in North Korea a/
1945-56

Billion Kilowatt-Hours

	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956
Planned		3.59 b/	3.80 c/	5.90 d/	6.50 e/	6.80 e/					3.1 f/	4.3 g/
Actual	2.50	3.93 h/	5.59 i/	6.13 j/	5.93 k/	3.00	0.8	0.9 l/	1.0 m/	2.0 n/	3.0 o/	4.3

a. Figures which are not sourced are estimates. For methodology, see Appendix C.
b. 42/
c. 43/. The wide variation between planned and actual production in 1947 is believed to be the result of including the 50-cycle production of the Sup'ung hydroelectric power plant, which was exported to Manchuria.
d. 44/
e. 45/
f. 46/
g. 47/
h. 48/
i. 49/
j. 50/
k. 51/
l. Based on an announcement that production in 1952 was 19 percent more than that in 1951. 52/
m. 53/
n. 54/
o. 55/. Another announcement states that the annual increase was 61 percent, 56/ resulting in an estimated production of 3.2 billion kwh.

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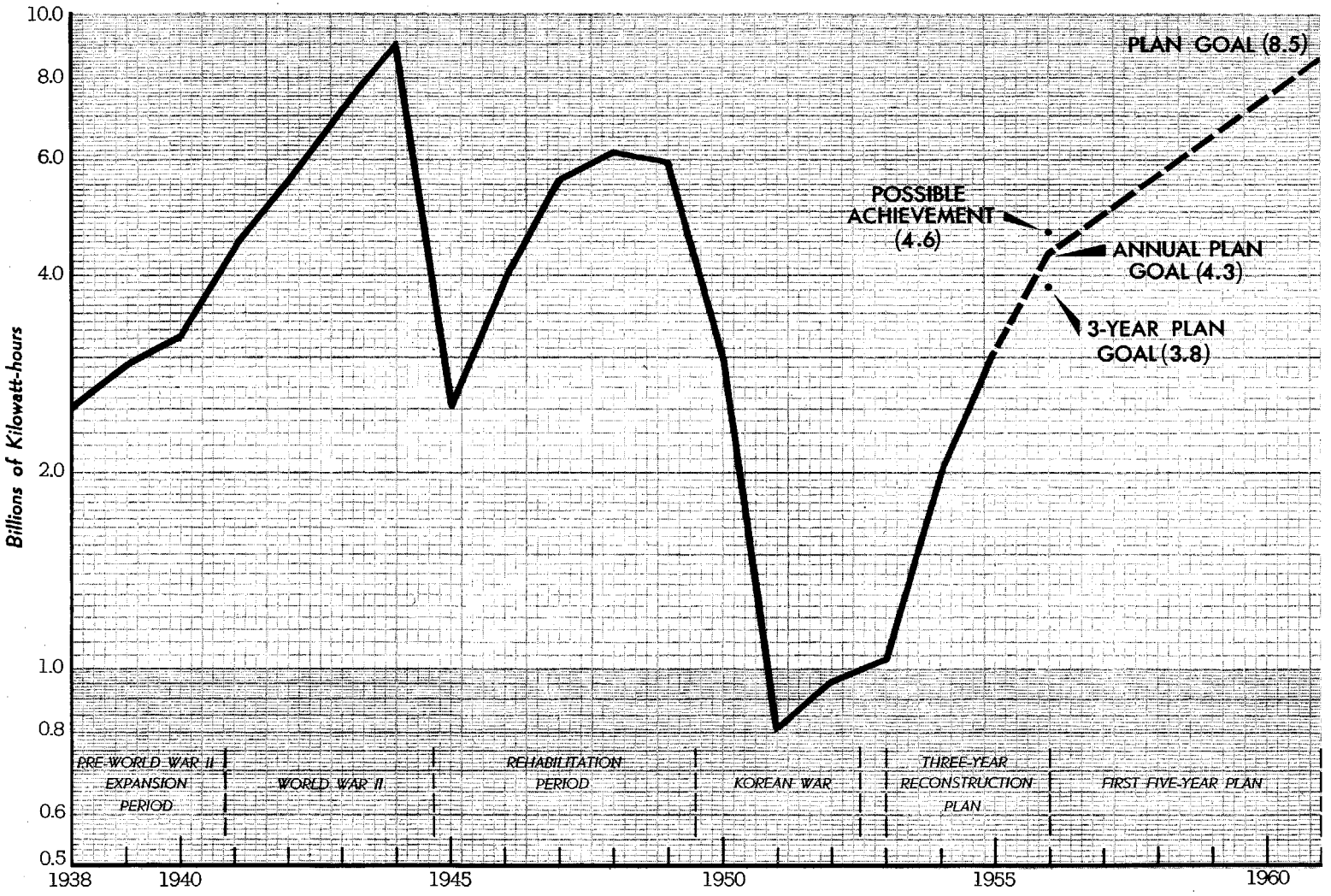
FIGURE 2

NORTH KOREA
ELECTRIC POWER PRODUCTION
1938-61



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In 1944, production of electric power in North Korea reached a peak of approximately 9 billion kwh, 57/ the result of an extremely rapid development which resulted in an annual average increase of almost 24 percent during 1938-44. After its collapse in 1945 the electric power industry strove to regain its peak production, and the goal for 1950 was set at 6.8 billion kwh, about three-fourths of the peak production. Because of the disruption caused by the Korean War in 1950, this goal was not reached. Notable progress had been made, however, particularly during 1946-49. After the Korean War the Three Year Reconstruction Plan (1954-56) goal of 3.8 billion kwh for 1956 was set in early 1954. 58/ This goal was revised in late 1955 to 4.3 billion kwh, slightly less than one-half of the 1944 peak. A recent announcement states that 4.6 billion kwh possibly will be produced in 1956, although the revised goal of 4.3 billion kwh appears to be more realistic.

The forecast of production of electric power through the period of the First Five Year Plan is shown in the following tabulation*:

	Billion Kilowatt-Hours				
	1957	1958	1949	1960	1961
Production	5.2	5.8	6.6	7.5	8.5

The goal for production of electric power for the First Five Year Plan is 8.5 billion kwh in 1961, 59/ an increase of nearly 100 percent over the estimated 1956 production of 4.3 billion kwh. It is estimated that in the same period, capacity will increase only about 20 percent, from 1.33 million kw to 1.6 million kw.** In spite of the disparity in rates of increase, the production goal is not impossible. It can be attained by a large increase in the annual hours of utilization of the generating capacity. Based on estimated production (kwh) and capacity (kw), the hours of utilization will be 3,233 in 1956. Fulfillment of the production goal for 1961 will require 5,313 hours of operation. In view of the high proportion of industrial use, this rate is within reason if the power-using industrial facilities are fully restored and operate on schedules approximating those of 1944.

* For methodology, see Appendix C.
** See IV, A, p. 19, below.

B. Consumption.

No statistical information is available on which to construct the current use pattern of electric power consumption in North Korea. The industrial economy, however, has not changed drastically since the Japanese occupation, and it is assumed that the use pattern will not have changed much since that time. The estimated use pattern of electric power in North Korea in 1943, 1956, and 1961 is shown in Table 9.

Table 9

Estimated Use Pattern of Electric Power in North Korea
1943, 1956, and 1961

Percent

Consuming Sector	1943 a/	1956	1961
Chemical industry	76	70	72
Metal industry	8	10	8
Mining industry	9	10	7
Other industry	3	3	5
Nonindustrial	4	7	8
Total	100	100	100

a. 60/

Total consumption is considered to be the total indigenous consumption -- that is, total production less exports, transmission losses, and use by power plants. The category "Other industry" includes agricultural consumption and consumption in the textile, machinery, ceramics, lumber, and food industries. The category "Nonindustrial" presumably includes such consumers as residential, commercial, municipal, and others. Variations in the estimated use pattern in 1956 and 1961, in relation to that in 1943, are based on fragmentary knowledge of the present and planned status of the various industries.

C. Exports.

The export of electric power to Manchuria from the Sup'ung hydroelectric power plant is an important element in the electric power industry of North Korea. No information is available as to the amount of this export, but some idea of the amount may be gained from a study of the generating and transmission facilities devoted to it. In the Sup'ung plant, four of the six 90,000-kw generating units can produce 50-cycle current, which is usable in Manchuria but not in North Korea. Thus 360,000 kw, two-thirds of the plant's capacity, could be allocated for export, although full use of this capacity for export has never been achieved, because the amount of export is limited by the capacity of the transmission lines into Manchuria. The transmission lines to An-shan and Dairen are estimated to be capable of carrying loads of about 130,000 kw and 120,000 kw, respectively. It is not known whether the lines have been used to their full capacity, but this potential 250,000 kw is almost one-fifth of the estimated total capacity of the electric power industry of North Korea in 1956. This indicates that export is an important element in the North Korean electric power industry and may become increasingly so in the future. The estimated supply of 250,000 kw is substantiated by the statement that one of the 50/60-cycle units at Sup'ung was always kept on a standby basis, 61/ thus reducing to 270,000 kw the capacity available for export. Before May 1948, about 60 percent of South Korea's electric power was supplied by exports from North Korea, 62/ mainly from the Hwach'on hydroelectric power plant, which is located just north of the 38th parallel. Since the end of the Korean War there have been no exports from North Korea to South Korea. The realignment of the boundary by the establishment of the truce line in 1953, however, has placed the Hwach'on power plant in South Korea.

IV. Growth.

A. Generating Facilities.

Although the electric power industry of North Korea has expanded only slightly since 1945, its growth before 1945, under the Japanese, was phenomenal. In 20 years the Japanese changed the economy of the northern half of Korea from purely agricultural to basically industrial. In this transformation the electric power industry was an essential element, as is shown by the fact that it increased almost 200 times during this period -- from a few scattered, small thermal electric power plants serving municipal areas to a well-developed system serving various industries, mainly the electrochemical complex at Hungnam.

Before 1945 the Japanese had further grandiose plans for the expansion of the electric power industry. They planned to more than double the installed capacity by constructing several systems of plants as follows 63/:

System	Planned Capacity (Million Kw)
Yalu River (6 plants)	1.10
Sodu-su (Seito-sui)	0.27
Kokai (Kanggye)	0.27
Tumen River (plans not completed)	0.26
Total	1.90

Of this total capacity, 1.5 million kw was to have been installed by 1950, and construction on some of the plants was under way before the Japanese surrender. 64/ The North Koreans are already completing construction previously started and will undoubtedly continue, although the extent to which they complete the ultimate goal of the Japanese will depend entirely on the demands of the economy on the electric power industry. The North Koreans are now completing construction of the Tongno and Kanggye plants (Kokai Nos. 3 and 4). 65/ The Tongno plant is planned for completion in 1959, and the Kanggye plant will be in partial operation in 1961. 66/ Because the operation of the Kanggye plant is dependent on the operation of the first 2 plants in the Kokai system, the partial operation of all 3 plants can be expected in 1961.

It is estimated that the capacity of the electric power industry of North Korea during the period of the First Five Year Plan will increase about 20 percent, which can be accounted for as follows:

Plant	Kilowatts
Unit No. 6 of Sup'ung plant (1957)	90,000
Tongno plant (Kokai No. 4) (1959)	72,000
Kanggye plant (Kokai No. 3) (partial operation)	14,000
Kokai No. 2 (partial operation)	32,000
Kokai No. 1 (partial operation)	40,000
Ch'ongjin thermal electric power plant	16,000
Total	264,000

With the additions indicated above, the resulting capacity will be about 1.6 million kw in 1961.

B. Transmission Facilities.

It will be necessary for the electric power transmission facilities of North Korea to be expanded along with the generating facilities to make the additional capacity available to the existing and newly developed load centers. In this expansion, the North Koreans probably will follow the Japanese plans closely.* It is believed that two 220-kv lines are now under construction and probably will be completed in 1957. These lines are one from the Tongno power plant to Sup'ung, which will supplement the supply on the west coast, and another from Sup'ung to P'yongyang via Unsan, 67/ which will provide additional power to the P'yongyang area and also will establish a firm interconnection between the east- and west-coast systems. During the period of the First Five Year Plan, this construction will add approximately 240 miles of transmission lines to the existing facilities.

C. Enlargement of Existing Facilities.

No information is available on the enlargement of any existing facilities, either generating or transmission, although there is the possibility that plans of this nature do exist. Economic considerations frequently dictate the enlargement of existing facilities rather than the construction of additional ones at new locations. Such an enlargement might possibly occur at Sup'ung because it would not require any additional major construction. This plant was originally constructed for the installation of seven 90,000-kw generators. The No. 5 generator was to have been installed in 1945, but it never arrived from the manufacturer, the Siemens-Schuckert Co., in Germany. 68/ Although this unit was planned for the supply of Manchuria, its installation at this time could be for the supply of North Korea.

D. Deterrents to Growth.

The inability of the North Koreans to manufacture heavy electrical generating equipment could affect the growth of the electric power industry. Present embargoes limit the sources of supply to those

* For planned transmission lines, see Figure 3, inside back cover.

countries of the Sino-Soviet Bloc which are capable of manufacturing the large sizes required -- specifically, the USSR, Czechoslovakia, and Hungary. The extent to which these countries will supply the equipment to North Korea may be governed by consideration of the over-all requirements of the Bloc. After such consideration, fulfillment of need probably would be on a priority basis.

Relaxation by the countries outside the Sino-Soviet Bloc of trade controls on the supply of heavy electrical generating equipment would benefit the North Korean electric power industry; Japan and other non-Bloc countries are capable of manufacturing the type and size of equipment required. The furnishing of spare and replacement parts by non-Bloc countries also would be simplified if export controls were relaxed. Present regulations permit the shipment of this kind of equipment to Bloc countries as exceptions to the controls under certain conditions. Also, because the existing facilities in North Korea are predominantly of Japanese origin, the supply of replacement parts could be supplied best by the original manufacturer.

V. Input Requirements.

A. Fuel.

Fuel is no problem to the electric power industry of North Korea, not only because so small a portion of total production comes from thermal electric power plants but also because there are ample indigenous supplies of coal for steam purposes.

B. Labor.

In North Korea, as in all other countries, the electric power industry requires a relatively small number of workers for its operations and therefore makes no serious demand on the total labor force. There is no information as to the number of workers now employed, but post-World War II statistics provide a base for an estimate. The 1948 plan required 6,800 workers, 69/ and because no new facilities were added, it is believed that employment in 1956 will be approximately the same, with about 40 percent of the total being trained technical personnel.

VI. Capabilities, Vulnerabilities, and Intentions.

A. Capabilities.

The electric power industry of North Korea, in spite of a very modest increase in capacity expected during the period of the First Five Year Plan, appears to be capable of meeting the presently forseeable demands of its industrial and other users. The lack of new capacity can be compensated for by much more intensive use of existing capacity than was possible under the disturbed conditions following World War II and during the Korean War. Capability for the long-range future of the electric power industry is good. The essential natural resources, water and coal, are adequate. Furthermore, engineering has been completed on many undeveloped hydroelectric sites, and construction at several of these sites has been started. Any addition to facilities will require the importation of all heavy electrical generating equipment, such as turbines and generators, although North Korea may be capable of manufacturing at least a part of the ancillary equipment such as wire, cable, transformers, tools, meters, reinforcing steel, cement, and penstocks.

B. Vulnerabilities.

North Korea is entirely dependent on external sources for the supply of heavy electrical generating equipment. If the supply of this equipment should not be forthcoming, the expansion of its generating facilities would cease. Based on present capacity, however, production of electric power could continue to grow to a possible maximum of about 8 billion kwh.

Another vulnerability concerns the water supply, particularly the way in which it is used. The electric power industry of North Korea is unique in that the production of electric power is based almost entirely on hydroelectric generating facilities. This type of system is extremely vulnerable to the vagaries of the weather because there must be an ample supply of water at all times. The climate of North Korea is monsoonal, and there is an average annual rainfall of about 34 inches. This amount is quite sufficient except that it is highly seasonal; approximately 80 percent of the annual rainfall falls from May through September, and the other 20 percent, from October through April. About one-half of the precipitation during the latter period, specifically from November through

March, is in the form of snow, which does not become available as water supply until April, when warmer weather begins. 70/ Thus the various hydroelectric power systems must have ample reservoir capacity to retain the summer deluge and to store it for at least 5 months. It is estimated that the total storage capacity of the present reservoirs (330 billion cubic feet) is capable of supporting the hydroelectric power systems through at least 1 year of extreme drought and 2 years with rainfall at 50 percent of the average.

Even with an adequate water supply, however, the major hydroelectric power systems, except Sup'ung, are vulnerable for another reason. The plants in these systems are constructed in a series at succeeding levels below the reservoir and are connected to it by tunnels and penstocks. Any serious damage, natural or manmade, to the dam, intake structure, tunnels, or penstocks would curtail or even completely interrupt the water supply to the plants in the system. During the Korean War, heavy bombing damage was inflicted on the water supply facilities. This damage, along with damage to other facilities, resulted in almost complete disruption of the supply of electric power for long periods of time.

C. Intentions.

The electric power industry of North Korea, when measured by changes in total capacity and production or by changes in use pattern, is not considered a good indicator of government military intentions. Such changes are too slow in development to act as indicators. On the other hand, production of electric power can be considered as a good measure of the economic growth of the country. Because electric power is so important in every phase of the national economy, it becomes an indicator only when its use can be pinpointed specifically to a purpose connected with the production of war materiel or the furtherance of war purposes. Planned large increases in production of such basic components of war materiel as steel, aluminum, and chemicals will entail plans for adequate electric power, but such increases do not necessarily indicate warlike intentions. As a specific example, the production facilities for chemical fertilizers, the major industry in North Korea, can be converted to the production of explosives quite simply because both processes use similar techniques and amounts of electric power.

APPENDIX A

ELECTRIC POWER GENERATING PLANTS IN NORTH KOREA

Electric power generating plants in North Korea in 1956 are shown in Table 10.* Table 10 lists in alphabetical order all reported sites of electric power generating plants, whether the plants were in operation in 1956, are under construction, or are planned for later construction. The various hydroelectric power systems are cross-referenced as an aid in identifying the plants composing each system.

Figures shown under "Estimated Capacity" represent estimated capacities for 1956, except where marked "under construction" or "planned." Plants under construction probably will be completed by 1961. The "planned" capacities represent Japanese intentions, but there is no information as to when and to what extent the plans may be carried out by the North Koreans.

* Table 10 follows on p. 26.

Table 10

Electric Power Generating Plants in North Korea a/
1956

Location	Coordinates	Name of Plant	Type b/	Estimated Capacity (Kilowatts)
Aoji-dong	42°31'N - 130°23'E		T	5,000
Changjin system (see Chosin system)				
Chongt'am-gol	42°04'N - 129°40'E	Funei No. 1	H	13,400
Chigong-ni	38°50'N - 127°51'E	Kongo-san No. 4	H	3,250
Chinhung-ni	40°11'N - 127°18'E	Choshin No. 2	H	100,000
Ch'ongjin	41°46'N - 129°49'E		T	16,000 c/
Ch'onnae-ri	39°22'N - 127°12'E		T	3,600
Choshin system (see Pohujang [Choshin No. 1] Chinhung-ni [Choshin No. 2] Hadae-ri [Choshin No. 3] Songdang-ni [Choshin No. 4])				
Chungdae-ri	38°48'N - 127°49'E	Kongo-san No. 2	H	7,000
Funei system (see Chongt'am-gol [Funei No. 1] P'altam [Funei No. 2] Yongdae-dong [Funei No. 3])				
Fusen system (see Songhung-ni [Fusen No. 1] Songhung-ni [Fusen No. 2] Hungnam-ni [Fusen No. 3] Sinhung [Fusen No. 4])				
Hadae-ri	40°07'N - 127°20'E	Choshin No. 3	H	36,000
Haeju	38°02'N - 125°42'E		T	3,000
Hoch'on system (see Kyosen system)				
Honggun-ni	40°47'N - 128°27'E	Kyosen No. 1	H	128,000
Hungnam	39°51'N - 127°37'E		T	13,000
Hungnam-ni	40°15'N - 127°36'E	Fusen No. 3	H	16,000
Hyangch'on-ni	38°49'N - 127°50'E	Kongo-san No. 3	H	3,250
Hyangha-dong	40°59'N - 126°39'E	Kokai No. 2	H (planned)	48,000
Kanggye	40°58'N - 126°36'E	Kokai No. 3	H (under construction)	28,000
Kanggye system (see Kokai system)				
Kojo system (see Kongo-san system)				
Kokai system (see P'yong-ni [Kokai No. 1] Hyangha-dong [Kokai No. 2] Kanggye [Kokai No. 3] Podulbat [Kokai No. 4])				
Komusan	42°07'N - 129°42'E		T	3,600
Kongo-san system (see Paekhu-ri [Kongo-san No. 1] Chungdae-ri [Kongo-san No. 2] Hyangch'on-ni [Kongo-san No. 3] Chigong-ni [Kongo-san No. 4])				
Kosong-ni	40°41'N - 128°37'E	Kyosen No. 2	H	64,000
Kumgang-san system (see Kongo-san system)				
Kuup-tong	40°54'N - 126°01'E	Yalu No. 3 (Igen)	H (planned)	160,000
Kyosen system (see Honggun-ni [Kyosen No. 1] Kosong-ni [Kyosen No. 2] Sangnong-ni [Kyosen No. 3] Pingaech'on [Kyosen No. 4])				
Manp'ojin	41°09'N - 126°17'E	Yalu No. 4 (Manpo)	H (planned)	136,000
Much'ang-dong	41°28'N - 127°18'E	Yalu No. 7 (Kosho)	H (planned)	120,000
Myongch'on	41°12'N - 129°29'E		T	4,000
Paekhu-ri	38°46'N - 127°47'E	Kongo-san No. 1	H	720
P'altam	42°03'N - 129°41'E	Funei No. 2	H	9,400
Pingaech'on	40°30'N - 128°50'E	Kyosen No. 4	H	64,000

a. Sources for this table are given in II, A, p. 5, above.
b. The abbreviation "T" stands for "thermal electric power plant"; the abbreviation "H," for "hydroelectric power plant."
c. Not believed to be fully restored or in operation.

Table 10

Electric Power Generating Plants in North Korea
1956
(Continued)

Location	Coordinates	Name of Plant	Type	Estimated Capacity (Kilowatts)
Podulbat	41°00'N - 126°13'E	Kokai No. 4	H (under construction)	72,000
Pohujang	40°13'N - 127°17'E	Choshin No. 1	H	128,000
Pongsan	38°31'N - 125°50'E		T	7,100
Pujon system (see Fusen system)				
Puryong system (see Funei system)				
Puyon-dong	41°53'N - 129°30'E	Sodu-su No. 1	H (planned)	116,000
P'yong-ni	40°58'N - 126°48'E	Kokai No. 1	H (planned)	120,000
Samgo-ri	41°54'N - 129°41'E	Sodu-su No. 2	H (planned)	116,000
Sangjang-dong	41°46'N - 126°57'E	Yalu No. 6 (Rinko)	H (planned)	80,000
Sangnong-ni	40°36'N - 128°44'E	Kyosen No. 3	H	60,000
Seito-sui system (see Sodu-su system)				
Sinhung	40°12'N - 127°34'E	Fusen No. 4	H	10,000
Sodu-su system (see Puyon-dong [Sodu-su No. 1] Samgo-ri [Sodu-su No. 2] Suwon-dong [Sodu-su No. 3])				
Songdang-ni	40°03'N - 127°23'E	Choshin No. 4	H	33,000
Songhung-ni	40°20'N - 127°33'E	Fusen No. 1	H	116,000
Songhung-ni	40°17'N - 127°40'E	Fusen No. 2	H	36,000
Suiho (see Sup'ung-dong)				
Sungho-ri	38°59'N - 125°59'E		T	10,200
Sup'ung-dong	40°27'N - 124°57'E	Yalu No. 2 (Sup'ung)	H	450,000
Suwon-dong	41°54'N - 129°44'E	Sodu-su No. 3	H (planned)	36,000
Tongno (see Podulbat)				
Uiju	40°12'N - 124°32'E	Yalu No. 1 (Uiju)	H (planned)	160,000
Unbong	41°22'N - 126°32'E	Yalu No. 5 (Umpo)	H (planned)	450,000
Yalu River system (see Uiju [Yalu No. 1] Sup'ung-dong [Yalu No. 2] Kuup-tong [Yalu No. 3] Manp'ojin [Yalu No. 4] Unbong [Yalu No. 5] Sangjang-dong [Yalu No. 6] Much'ang-dong [Yalu No. 7])				
Yongdae-dong	42°02'N - 129°42'E	Funei No. 3	H	5,200

APPENDIX B

MAJOR ELECTRIC POWER TRANSMISSION FACILITIES IN NORTH KOREA

Tables 11, 12, and 13* are to be used in conjunction with the map.** A comparison between Table 11 and the tabulation on transmission lines in 1949*** reveals that the only transmission line not specifically accounted for is the 9 miles of single-circuit 110-kv line.*** Although the location of this line is unknown, it probably is an interconnection between the Hungnam substations.

* Tables 11, 12, and 13 follow on pp. 30, 31, and 32, respectively.
** See Figure 3, inside back cover.
*** P. 14, above.

Table 11

Major Electric Power Transmission Lines in North Korea
1956

Line Terminals	Voltage (Kilovolts)	Remarks [a]
Sup'ung-Tasado [b]	220	Single-circuit, 47 miles
Sup'ung-P'yongyang [b]	220	Single-circuit, 111 miles
P'yongyang-Namp'o [b]	220	Single-circuit, 25 miles
Hungnam - Kyosen No. 2 [c]	220	Single-circuit, 85 miles
Kyosen No. 1 - Kyosen No. 3 [c]	220	Single-circuit, 21 miles
Kyosen No. 3 - Susong [c]	220	Single-circuit, 105 miles
Choshin No. 2 - P'yongyang [b]	154	Double-circuit, 125 miles
P'yongyang-Seoul [b]	154	Double-circuit, 85 miles (P'yongyang-Kaesong)
Songyang-Unsan [b]	154	Single-circuit, 39 miles
P'yongyang interconnection [b] (Ch'oech'on - Yul-li)	154	Double-circuit, 11 miles; now operating at 66 kv
Choshin No. 2 - Kigong [c]	110	Double-circuit, 15 miles
Choshin No. 3 - Hungnam [c]	110	Double-circuit, 20 miles
Fusen No. 1 - Kigong [c]	110	2 double-circuit, 23 miles
Kigong-Hungnam [c]	110	3 double-circuit, 14 miles
Choshin No. 1 - Choshin No. 2 [c]	110	2 double-circuit, 4 miles
Choshin No. 2 - Choshin No. 3 [c]	110	Double-circuit, 3 miles
Kyosen No. 3 - Tanch'on [c]	110	Double-circuit, 14 miles
Kigong-Tanch'on [c]	110	Double-circuit, 77 miles
Tanch'on-Susong [c]	110	Double-circuit, 97 miles
Susong - Aoji-dong	110	Double-circuit, 65 miles

a. A single-circuit transmission line is composed of 3 wires, whereas a double-circuit line consists of 6 wires on the same structure, thus doubling the capacity of the line.
b. 71/
c. 72/

Table 12

Major Electric Power Substations in North Korea
1956

Location	Remarks
Kigong a/	110-kv switching station linking the Chosin and Fusen systems with Tanch'on.
Tanch'on a/	110-kv switching station linking Kikoku with the Kyosen system.
Hungnam b/	220/110/11-kv transformer station supplying the chemical works. Estimated capacity is 460,000 kva (400,000 kw).
P'yongyang c/ (near Ch'oech'on) (39°02'N - 125°40'E)	No. 2 transformer station, 220/66 kv. A 200,000-kw rotary condenser is being installed in order to increase the supply from Sup'ung.
P'yongyang d/ (near Yuli-li) (39°00'N - 125°47'E)	No. 1 transformer station; originally had five 50,000-kva, 154/66-kv transformers.

a. 73/
b. 74/
c. 75/
d. 76/

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Table 13

Major Planned Electric Power Transmission Lines and Substations in North Korea a/
1956

Line Terminals	Voltage (Kilovolts)	Remarks
Sup'ung-Unsan-P'yongyang	220	Possibly by 1961; 120 miles
Sup'ung - Kuup-tong - Unsan	220	Possibly by 1961; 120 miles
Kuup-tong - Kokai No. 4	220	Possibly by 1961; 10 miles
Unbong - Sangjang-dong - Much'ang-dong - Kokai No. 1	220	Planned; 100 miles
Kuup-tong - Manp'ojin	220	Planned; 20 miles
Kokai No. 1 - Hungnam	220	Planned; 100 miles; possibly double-circuit.
Kokai No. 3 - Kokai No. 1	110	Possibly by 1961; 20 miles
Kokai No. 3 - Manp'ojin	110	Planned; 20 miles
Unsan substation		Switching and transformer station, 220/154/66-kv. Major planned interconnection between east- and west-coast systems.

a. 77/. As with the planned generating facilities, these lines and substations are Japanese intentions and may or may not be constructed by the North Koreans, depending on the expansion of the planned generating facilities.

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APPENDIX C

METHODOLOGY

1. Estimates of Capacity (Table 1* and Figure 1**).

The capacity of the electric power industry of North Korea in 1944 has been confirmed as 1.41 million kw. 78/ The only additional equipment known to have been installed in 1945 was another 90,000-kw unit at Sup'ung. 79/ Thus the maximum capacity attained under the Japanese was 1.5 million kw. This base figure of 1.5 million kw supports the 1949 figure of 1.24 million kw because a compilation of intelligence material indicates that

a. 180,000 kw (two 90-000-kw units) were removed by the USSR from the Sup'ung plant.

b. About 100,000 kw were damaged or destroyed by the Japanese, of which possibly 20,000 kw were restored.

c. No new plants were built from 1945 to 1949.

This net reduction of 260,000 kw brings the 1949 capacity to 1.24 million kw. The estimates of capacity for 1950 to 1952 are based on CIA information describing conditions known or believed to have existed during those years. The estimate for 1956 is based on the summation of the capacities of individual plants known or believed to be in operation and is confirmed by the Three Year Plan goal.

2. Estimates of Production (Table 8*** and Figure 2****).

The estimates of production of electric power in North Korea for 1945 and for 1950-52 are based on fragmentary information about conditions existing after World War II and during the Korean War.

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* P. 6, above.
** Following p. 6.
*** P. 16, above.
**** Following p. 16.

Estimates of production of electric power during each year of the First Five Year Plan* are based on the estimated annual capacity increases during the period and on the assumption that the Plan goal of 8.5 billion kwh will be reached. The average operating hours in 1956 and in 1961 were calculated from the estimated total production and capacity in those years, and then the increase in operating hours was allocated on a logarithmic scale over the 5-year period. The product of capacity times hours resulted in the estimates of production, as follows:

	1956	1957	1958	1959	1960	1961
Capacity (million kw)	1.33	1.45	1.48	1.51	1.55	1.6
Hours (thousands)	3.23	3.57	3.94	4.36	4.81	5.31
Production (billion kwh)	4.3	5.2	5.8	6.6	7.5	8.5

* See p. 17, above.

APPENDIX D

GAPS IN INTELLIGENCE

Information on the electric power industry of North Korea during the Japanese occupation is adequate. A 1950 US Army study and various captured Japanese documents were extremely helpful in gaining a good historical background on the industry. The lack of information on almost all aspects of the industry since 1945 makes a definitive study of the industry very difficult.

Information on the reconstruction of electric power generating and transmission facilities in North Korea has been obtained almost entirely from press and radio announcements, which are couched in the vaguest terms and are very difficult, sometimes impossible, to interpret. The lack of covert reports has hindered the confirmation of these announcements. Except for planned goals for production and capacity in 1956, all announcements have been stated in terms of increase over previous achievement, which has not always been defined clearly. In some instances, conflicting conclusions have been reached.

Specifically, there is a lack of the following types of information:

1. Generating facilities

    a. Installed capacity
    b. Periodic production: annually, quarterly, or monthly
    c. Degree of rehabilitation
    d. Operating hours of equipment
    e. New facilities or plans for them

2. Transmission facilities

    a. Capacity of specific lines
    b. Location of new or proposed facilities

3. Electric power consumption by principal classes of users and particularly by specific industries which are large users of electric power.

4. Inputs, including quantity and source of equipment, labor, technical assistance, and investment.

5. Export of electric power across international boundaries, specifically actual annual delivery.

6. Over-all statistics on total generating capacity and total production of electric power.

The types of information listed above are necessary for the period since 1950, and the most recent information is the most valuable.

Although there are gaps as indicated above, it should not be inferred that information is completely lacking. The available information is varied and fragmentary and frequently cannot be confirmed.

APPENDIX E

SOURCE REFERENCES

In compiling historical background information for use in this report, the report Electric Power Resources -- Northern Korea, published by the US Army, Far East Command, in 1950, was extremely helpful. Information on reconstruction, expansion, plans, and plan results was obtained almost entirely from KCNA radio reports, published both by CIA, FBIS, and by the Monitoring Service of the BBC. Very little usable information can be attributed to covert collection, although what has been collected generally can be confirmed by open sources.

Evaluations, following the classification entry and designated "Eval.," have the following significance:

Source of Information	Information
Doc. - Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which may carry the field evaluation "Documentary."

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

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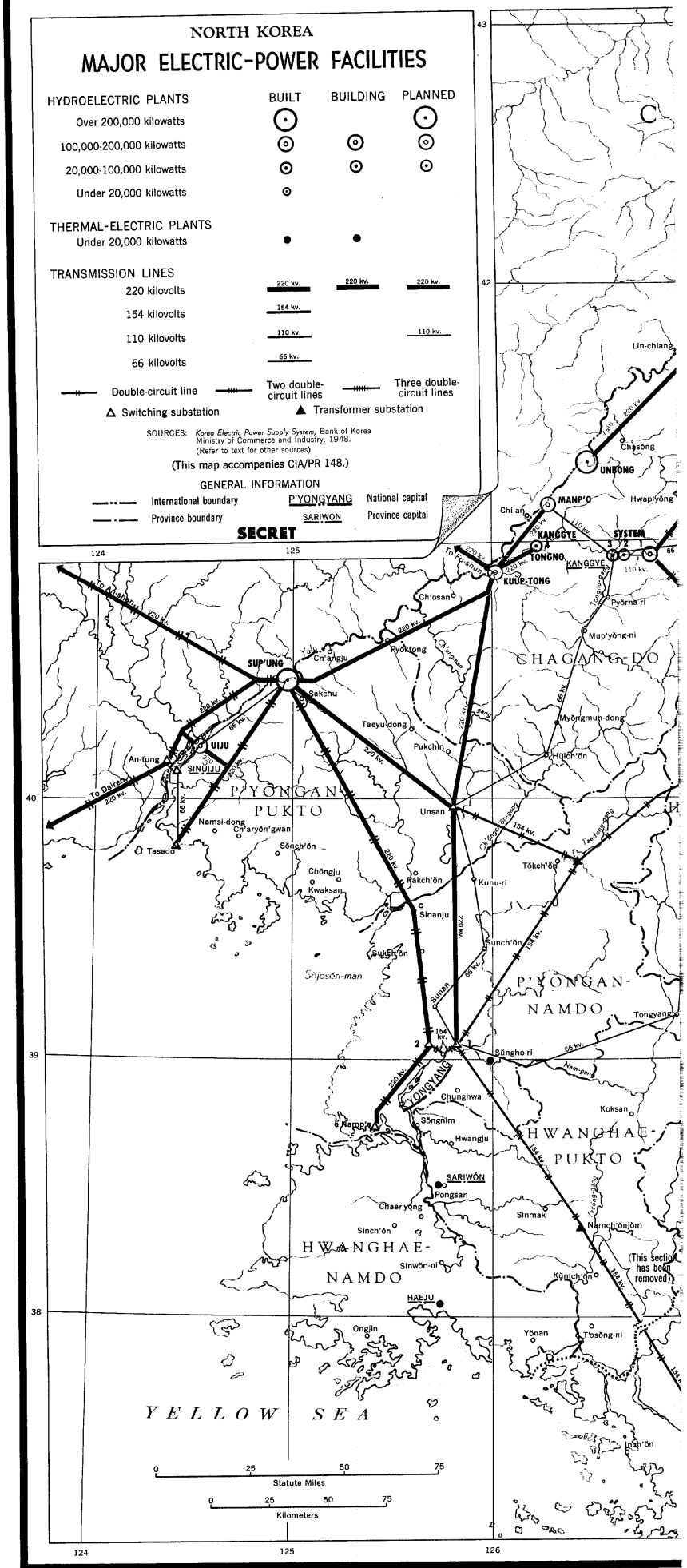
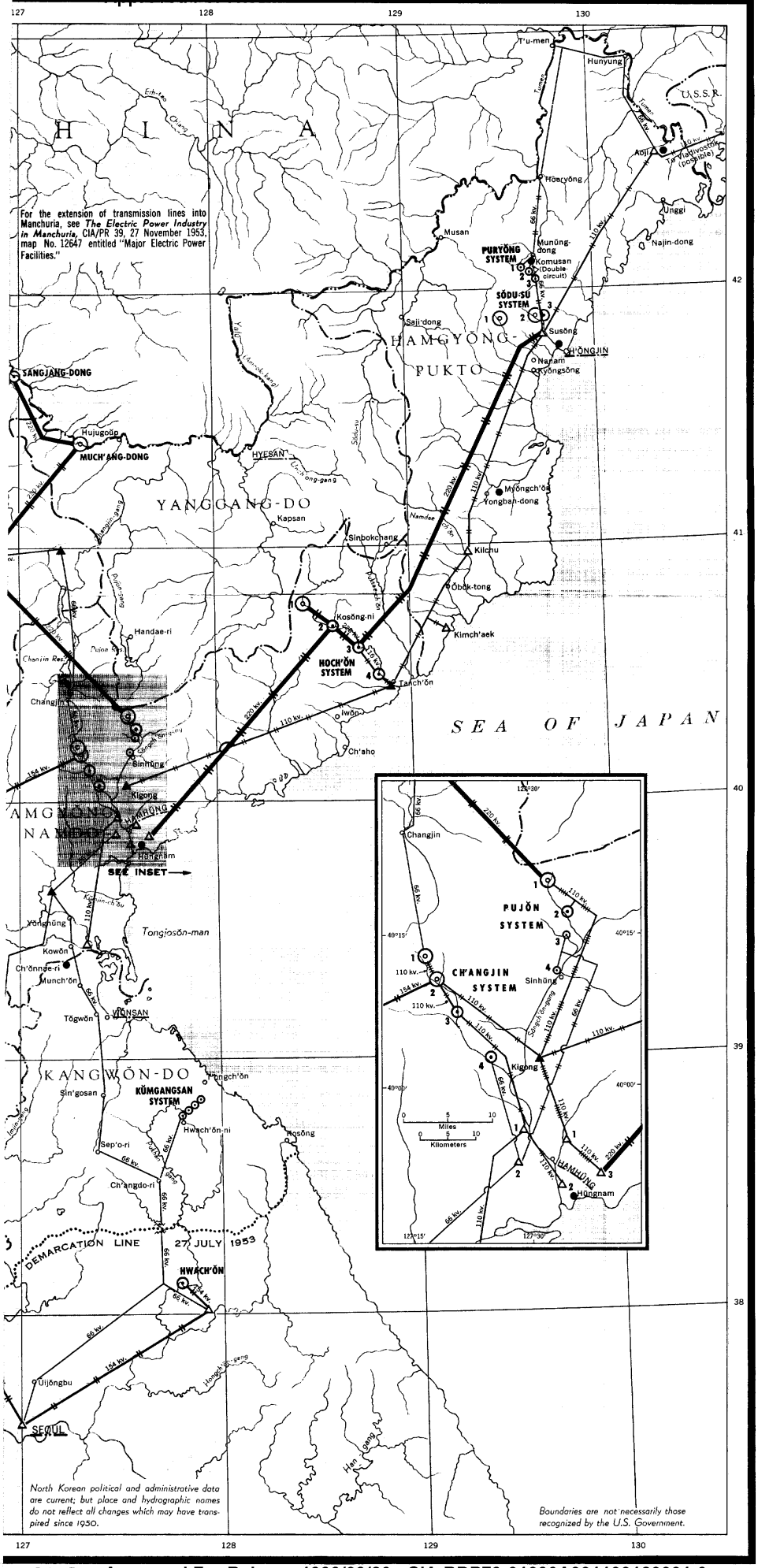
Next 5 Page(s) In Document Exempt

Approved For Release 1999/09/26 : CIA-RDP79-01093A001100120001-3




127
128
129
130
42
41
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CHINA
U.S.S.R.
T'u-men
Hunyung
Hoeryŏng
Aoji
Vladivostok (possible)
Unggi
Najin-dong
Musan
PUKYŎNG SYSTEM
Munŭng-dong
Komusan (Double-circuit)
SŎDU-SU SYSTEM
Saji-dong
Susŏng
CH'ŎNGJIN
Nanam
Kyŏngsŏng
HAMGYŎNG-PUKTO
SANGJANG-DONG
Hujugoŏ
MUCH'ANG-DONG
HYESAN
YANGGANG-DO
Kapsan
Myŏngch'ŏn
Yongban-dong
Sinbokchang
Kilchu
Ŏbŏk-tong
Kosŏng-ni
HOCH'ŎN SYSTEM
Kimch'aek
Handae-ri
Tanch'ŏn
Changjin
Iwŏn
SEA OF JAPAN
Ch'aho
Sinhŭng
Kigong
HAMGYŎNG-NAMDO
Hŭngnam
SEE INSET
Yŏngŭng
Tongjosŏn-man
Kowŏn
Ch'ŏnnae-ri
Munch'ŏn
Tŏgwŏn
WŎNSAN
KANGWŎN-DO
Sin'gosan
KŬMGANGSAN SYSTEM
Pongch'ŏn
Hwach'ŏn-ni
Kosŏng
Sep'o-ri
Ch'angdo-ri
DEMARCATION LINE 27 JULY 1953
HWACH'ŎN
Uijŏngbu
SEOUL
PUJŎN SYSTEM
CH'ANGJIN SYSTEM
Miles
Kilometers
For the extension of transmission lines into Manchuria, see The Electric Power Industry in Manchuria, CIA/PR 39, 27 November 1953, map No. 12647 entitled "Major Electric Power Facilities."
North Korean political and administrative data are current; but place and hydrographic names do not reflect all changes which may have transpired since 1950.
Boundaries are not necessarily those recognized by the U.S. Government.